NATURAL SCIENCES
GRADE 8 TEACHING NOTES

TERM 2

Lesson Title: 2.1 Atoms - Building blocks of matter

Sub-Topic Atoms

Resource 1: Periodic Table (Refer to the periodic table in your study guide / textbook)

Vocabulary

TERM EXPLANATION

1. **Atom:** An atom is the smallest particle of matter that can exist on its own.

2. **Nucleus:** A nucleus is the central region of an atom.

3. **Element** An element consists of atoms of only one kind.

4. **Diatomic molecule:** it is a molecule that consists of two atoms of the same kind.

5. **Compound:** A compound consists of atoms of two or more different elements chemically bonded together.

6. **Pure substance:** a pure substance consists of atoms or molecules of the same kind.

7. **Chemical bond:** a chemical bond is the force that holds atoms together in a molecule.

8. **Electrolysis:** Electrolysis is the decomposition of a compound when an electrical current is passed through a solution of the compound.

9. **Mixture:** A mixture is formed when two or more different elements or compounds are mixed

10. **Physical:** means Separation by physical means is the manual separation by hand or apparatus

11. **Indivisible:** Unable to be divided or cut up

12. **Noble gases:** Six gases that occur naturally as atoms

Questions

1. What is matter?

2. What are the smallest building blocks of matter?

1. Explanation:

a. Matter is everything that we can see, living or non-living.

b. Although surfaces of objects look smooth, they are all made up of particles called atoms.

c. We cannot see these atoms because they are too small.

d. We can only see atoms when there are enough of them together in one place and if we have a microscope.

e. A single grain of salt contains about 1 000 000 000 000 000 000 (a trillion) atoms.

f. The word 'atom' means indivisible, which means that an atom cannot be cut into smaller pieces.

2. Use the **Periodic Table** to explain the following:

a. Atoms of one element are different from atoms of another element.

b. When we look at the **Periodic Table**, copper atoms (Cu) are different from zinc atoms (Zn) because they have different chemical properties and masses.

c. However, all copper atoms are the same. They have the same properties and mass.

d. The atoms of the Noble Gases exist individually (point to the symbols in the last column: helium (He), neon (Ne), argon (Ar), krypton (Kr), xenon (Xe) and radon (Rn).

e. The atoms of other elements, such as hydrogen (H), oxygen (O) and nitrogen (N), combine to form diatomic molecules.

TASK
Draw the model for the following:

Atoms of the element helium (He)	Diatomic molecules of the element oxygen (O)

TASK Use 10 beads/ dried lentils/ dried peas, glue and a paper plate (or any reasonable materials) to make a model of

i. Atoms of the element helium (He)
ii. Diatomic molecules of the element oxygen (O)

Questions
3. Are all the atoms the same?

4. What are two identical atoms that exist together called?

Lesson Title: Sub-atomic particles

Sub-Topic Protons, neutrons and electrons

NOTES

SUB-ATOMIC PARTICLES
1. An atom is made up of smaller sub-atomic particles, namely protons, neutrons and electrons.

2. The protons and neutrons are situated in the nucleus of the atom.

3. The nucleus is at the centre of the atom.

4. The electrons move around the atom.

5. The protons are positively charged.

6. The neutrons are neutral and have no charge.

7. The electrons are negatively charged.

8. A neutral atom has the same number of positive and negative charges.

2. Explanation:

a. The sub-atomic particles in an atom are protons, neutrons and electrons.

b. The protons and neutrons are found in the nucleus of the atom.

c. The electrons move around the nucleus.

d. The protons have a positive charge and the neutrons are neutral.

e. The electrons are negatively charged.

f. The neutral atom has the same number of protons and electrons.

Questions

5. What are the two sub-atomic particles that are found in the nucleus of the atom?

6. What is the charge of an electron?

TASK

Use the beads / lentils / peas, glue and paper plate (or any reasonable materials) to make a model of a nitrogen atom. A nitrogen atom has seven protons, seven neutrons and seven electrons. Each type of sub-atomic particle should be a different colour.

Label each sub-atomic particle.

Questions

7. What is the overall charge of the nucleus of an atom?

8. How many electrons does a neutral atom with 17 protons have?

Lesson Title: Elements

Notes

1. An element is made up of only one kind of atom.

2. Elements cannot be broken down into simpler substances.

3. There are 118 known elements and they are listed in the Periodic Table.

4. The elements are arranged in the Periodic Table in order of their atomic number.

5. The atomic number of an element is the number of protons that an atom has in its nucleus.

6. Each element has its own name, symbol and unique properties.

7. Some elements consist of single atoms while other elements consist of diatomic molecules.

8. A molecule is two or more atoms that are bonded together to form a unit.

9. A diatomic molecule consists of two identical atoms.

10. Atoms of different elements are different. They have different numbers of protons, neutrons and electrons.

2. Explanation:
a. Although everything is made of atoms, not all atoms are the same.

b. The atoms of the same element are all identical but atoms of different elements are different.

c. Elements cannot be broken down into simpler substances or changed into another element by chemical methods.

d. Each element has its own particular name, symbol and properties.

e. There are 118 known elements and they are listed in the Periodic Table.

f. When an element consists of single atoms, we call them the atoms of the element.

g. When an element consists of diatomic molecules, we call them molecules of the element.

h. The atoms of different elements have different numbers of protons, neutrons and electrons.

*What is the difference between a carbon atom and a helium atom? *(Answer: A carbon atom has six protons, six neutrons and six electrons. A helium atom has two protons, two neutrons and two electrons.)*

Questions
9. What does an element look like on the atomic level?

10. Which table summarises in an orderly way all the elements known to us?

1. Explanation:
a. All the atoms of a specific element are identical. For example, the element sulphur consists only of sulphur atoms.

b. Even when an element consists of diatomic molecules, the atoms of the molecules are still identical. For example, the atoms of the diatomic molecules of chlorine are both chlorine atoms.

c. There are seven diatomic molecules: nitrogen (N2), hydrogen (H2), oxygen (O2), fluorine (F_2), chlorine (Cl_2), iodine (I_2) and bromine (Br_2).

d. Each element has its own particular symbol and own unique properties. For example, the symbol for sulphur is S and sulphur is a yellow, non-metal powder.

e. Scientists all over the world use the same symbols for the elements that are listed in the Periodic Table.

f. You might think that because there are so many materials in the world there must be millions of different elements. However, all materials are made up of only a small number of elements.

g. There are 118 known elements of which 93 elements occur naturally, while 25 elements are made by scientists in laboratories.

h. Elements are arranged in the Periodic Table according to their atomic numbers, which are the number of protons in the nucleus.

i. The first element is hydrogen because a hydrogen atom has one proton in its nucleus. The second element is helium because a helium atom has two protons in its nucleus.

Using this system, we can go on listing the elements.

TASK
Copy the table in your book. Use the Periodic Table to complete the table for the first 20 elements.

Name of element	**Symbol of element**	**Number of protons in the nucleus of an atom**
1. Hydrogen	H	
2. Helium		
3.		

Questions
11. How are the atoms of one element different from the atoms of another element?

12 How many protons and electrons does a neutral magnesium element have?

Lesson Title: Compounds

Notes
1. A **compound** is a material that consists of atoms of two or more different elements that are chemically bonded together.

2. The atoms in a given compound are always combined in a fixed ratio to form molecules.

3. A molecule is the smallest part of a compound and consists of two or more different atoms that are bonded together.

4. A compound consists of molecules of the same type.

5. A **chemical bond** is the force that holds atoms together in a compound.

6. The properties of a compound are different from the properties of the elements that it is made of.

7. Compounds can be broken down into their original elements by heating or electrolysis.

8. Electrolysis is the process where an electrical current is passed through a solution of a compound.

2. Explanation:
a. A compound is formed when atoms of different elements are joined together in a fixed ratio during a chemical reaction.

b. The smallest part of a compound is a molecule. The molecule of a compound consists of atoms of two or more elements.

c. The atoms are held together in the molecule of a compound by chemical bonds. A chemical bond is a strong force of attraction that holds the atoms together.

d. A compound can be separated into its constituent elements by chemical means only, such as heat or electricity.

e. When we pass an electrical current through a solution of a compound, the compound can be decomposed into the elements that formed the compound. This process is called electrolysis.

Questions

13. How are the atoms held together in a molecule?

14. What do we call molecules of the same type?

1. Explanation:

a. A compound is formed by a chemical reaction of two or more different elements. An example is water (H_2O).

b. Show the learners Resource 4 and tell them that the diagram shows a model of water molecules. The circles represent the different atoms.

c. Water molecules are very small. In one water drop, there are millions of water molecules. Water molecules are too small to see with the naked eye.

d. When hydrogen atoms (H) combine chemically with oxygen atoms (O), they form water molecules (H_2O). The elements hydrogen and oxygen react to form the compound water.

e. Each water molecule consists of two hydrogen atoms and one oxygen atom. The hydrogen atoms and oxygen atoms combine in a fixed ratio of 2:1.

f. The hydrogen and oxygen atoms are held together by a chemical bond, which is represented by the black line between them.

g. Water has different properties to oxygen and hydrogen. For instance, water is a liquid that we can drink whereas oxygen is a gas that we inhale.

2. Explanation:

a. If elements can combine to form a compound, a compound can be broken up into its elements again.

b. This is called the decomposition of a compound.

c. A compound can be decomposed by electrolysis where we use an electrical current to split up the compound into the elements it is made of.

d. Water can be decomposed into hydrogen and oxygen by means of electrolysis.

e. Thermal decomposition takes place when heat is used to break up a compound into the elements it is made of.

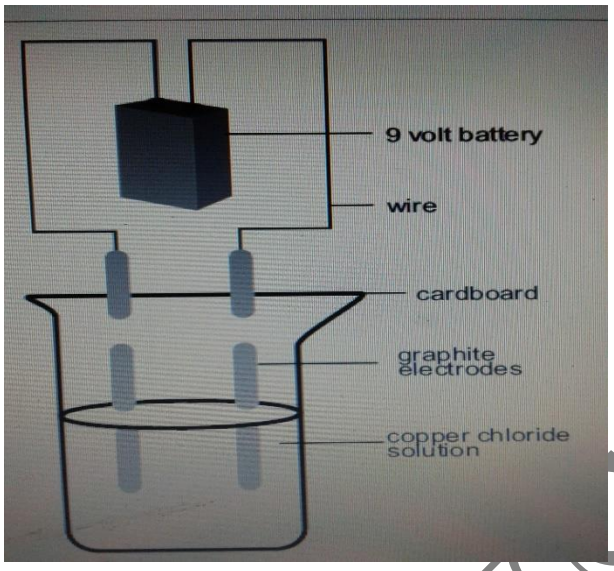
f. When mercury oxide (HgO) is heated, it will be decomposed into mercury and oxygen.

EXPERIMENT (In the laboratory)

Educator only: An experiment where copper chloride is decomposed.

Learner: Observe carefully what is happening at each electrode and answer the following questions.

First, draw the set-up for the experiment and label the parts.



Electrolysis of copper chloride solution

1. What did you observe at the one electrode?

2. What element was formed at this electrode?

3. What did you observe at the other electrode?

4. What element was formed at this electrode?

5. What are the two elements that copper chloride was decomposed to?

Answers:

1. The electrode has turned brown.

2. Copper metal

3. Bubbles that smell like chlorine pool cleaner.

4. Chlorine gas

5. Copper chloride was decomposed to form copper and chlorine.

Questions

15. What atoms are water molecules made of?

16. How can a compound be decomposed into its elements?

Lesson Title: Pure substances

Notes:

- How is a compound different from an element?
- *An element consists of atoms that are of the same type and a compound consists of molecules that are of the same type.*

PURE SUBSTANCES

1. A **pure substance** consists of only one kind of atom or molecule.

2. Elements and compounds are pure substances.

3. The atoms or molecules that a substance consists of determine whether a substance is pure.

2. Explanation:
a. A substance is pure when it consists of only one type of atom or one type of molecule.

b. There are only two classes of pure substances, namely elements and compounds.

c. All the other substances are not considered pure substances.

d. Substances may look pure but we can only know whether they are pure when we look at the particles that they consist of.

Questions
17. What substances are pure substances?

18. When is a substance a pure substance?

1. Explanation:
a. When people talk about pure substances they usually mean substances without impurities.

b. Look at the glass of water. Do you think the water is pure?

c. The water in the glass is only pure when there are only water molecules in the water.

d. Observe an element silicon where all the atoms are silicon atoms.

e. Observe a salt pot with salt.

Observe microscopic model of a table of salt crystal. The chemical name for table salt is sodium chloride.

f. Table salt is a compound that is made of sodium atoms (the small circles) and chlorine atoms (the big circles). They react in the ratio 1:1. For every one sodium atom, there is one chlorine atom.

g. Table salt is a pure substance because it only consists of sodium chloride molecules.

Questions
19. Why is copper a pure substance?

20. When do we consider a glass of water a pure substance?

Lesson Title: Mixtures and separation of mixtures

Notes:

MIXTURES
1. A mixture consists of two or more substances that are mixed together, but not chemically combined, to form a new substance.

2. A mixture has the combined properties of the substances that form the mixture.

3. Elements and compounds are mixed together to form mixtures.

4. The amounts of substances can vary in a mixture.

5. In some mixtures we can recognise the different substances that make up the mixture.

6. In some mixtures it is not possible to see the different substances that make up the mixture.

SEPARATION OF MIXTURES

7. A mixture can be separated into separate substances by **physical means**.

8. Separation by physical means is separation manually by hand or with apparatus.

9. Separation techniques are:

a. Hand sorting

b. Filtration and sieving

c. Evaporation and crystallisation

d. Decanting

e. Distillation

f. Chromatography.

10. Mixtures are separated according to the properties of the substances that make up the mixture.

2. Explanation:

a. Elements and compounds are often found mixed together.

b. None of the substances in a mixture are chemically bonded together and the amount of each substance can vary in the mixture.

c. When substances are mixed, they do not form a new substance. The properties of the mixture are a combination of the properties of the substances that are mixed.

d. Sometimes, the different substances that are mixed can be distinguished. However, in some mixtures the different substances in the mixture cannot be identified.

e. Substances in a mixture can be separated by using separation techniques, such as hand sorting, filtration, sieving, decanting, evaporation, crystallisation, distillation and chromatography.

f. The properties of the substances in the mixture will determine the separation technique that is used.

Questions

21. What is a characteristic of a mixture?

22. Can you give one separation technique for mixtures?

Explanation

a. There are not many pure substances in our everyday lives. Most of the substances around us are mixtures of elements and compounds.

b. Examples of mixtures include the air that we breathe (oxygen, nitrogen, carbon dioxide), fizzy drinks (cold drink and carbon dioxide [bubbles]) and steel (iron and carbon).

c. Mix water and sugar in a glass. The sugar and water did not react chemically to form a new substance. The sugar molecules mixed with the water molecules by moving in between the water molecules.

d. The sugar water mixture still has the properties of the water because it can be poured into another glass. The mixture also has the properties of the sugar because it tastes sweet.

e. We can have any proportion of water and sugar. When we add more sugar to the water, we still have a sugar water mixture.

f. We cannot see the sugar in the mixture but we know that it is there.

g. Make a mixture of water and sand. When we mix sand and water, we can see the sand in the water.

2. EXPLANATION

a. When an element or compound in a mixture is needed in its pure form, it can be separated from the mixture.

b. The separation methods that we use are different depending on the substances that are mixed.

c. Show the mixture of peanuts and raisins. When the particles are big enough, we can use hand sorting to separate the particles. Ask one of the learners to separate the peanuts and raisins.

d. Filtration or sieving can be used to separate the sand and water in the sand water mixture because the sand is visible. Let a learner pour the sand water through a tea sieve/ strainer or filtration paper. The water will move through the sieve or filter paper while the sand will stay behind.

e. To separate the sugar from the water in the sugar water mixture, the mixture can be left in the sun so that the water can evaporate. The sugar crystals will be left behind in the container.

f. Mix oil and vinegar in a bottle. The oil and vinegar can be separated by decanting because the oil floats on top of the vinegar. Ask a learner to pour the oil into another container.

TASK

Copy the table and write down the **five** differences between mixtures and compounds (pure substance).

Compounds	Mixtures
1	
2	

Questions

23. Name the differences in the separation of compounds and mixtures.

24. Why can we not separate sugar and water in a sugar water mixture by filtration or sieving?